

Methodology for flocculation control

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DESCRIPTION AND SPECIAL FEATURES

The study or control of the flocculation or coagulation processes is carried out by monitoring the evolution of the particles chord size distribution in real time by a focused beam reflectance measurement technique (FBRM).

This methodology allows us to determine optimal dosages of products, to study the kinetics of the flocculation processes, as well as those of the floc breakage (deflocculation) and reflocculation processes. From these studies, it is possible to determine floc properties and to propose the flocculation mechanisms model that explains the flocculant behavior for each specific case.

The measurement technique used by the developed methodology consists of a commercial Mettler Toledo probe, which is introduced in the suspension or in the pipe, and an electronic box with a detector. A computer system controls the equipment and receives the data. This equipment is provided with a laser diode that generates a laser beam which is split in different parallel beams. These beams are focused in a point (focal point) on the external sapphire probe window (sited in the extreme of the probe that is introduced on the suspension) through a rotating lens. The focal point describes a circular path at high speed as a result of the rotation of the lens.

When a particle crosses the focal point path, light reflected is conducted to the detector, which receives light pulses, whose duration is proportional to the particle chord.

The equipment can measure thousands of particles per second and obtain a chord length distribution, representative of the particle population. This distribution contains information about the size and concentration of particles, the variation of which, is inherent to the flocculation process with independence to the mechanism through which the process takes place.

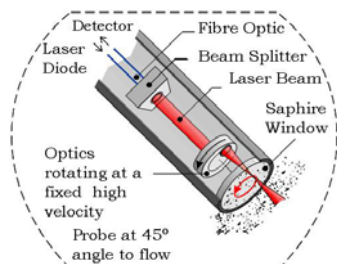


Figure 1.- Scheme of the FBRM probe.

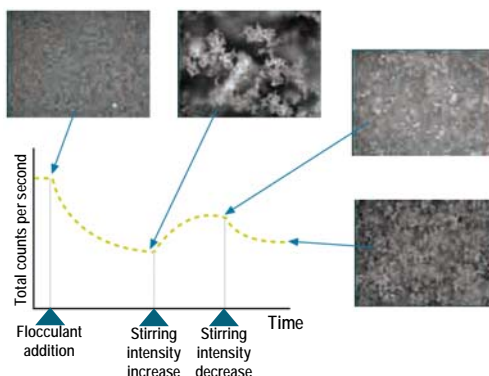


Figure 2.-Flocculation-deflocculation-reflocculation processes.

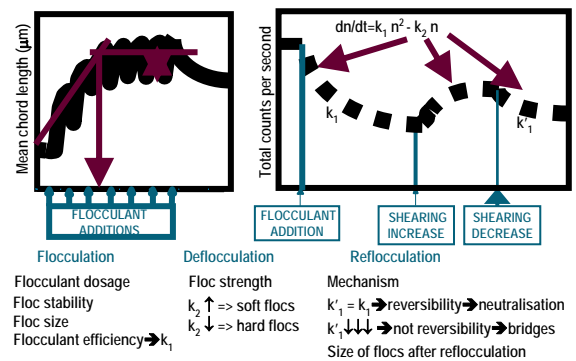


Figure 3.-. Developed flocculation methodology.

INNOVATIVE ASPECTS

The traditional methodologies, based on the measurement of the surface charge of the particles, are only appropriate to study the aggregation process when it implies the modification of these properties, but not when the flocculation is carried out by other mechanisms, as bridging with neutral polymers, for example. However, the developed methodology is not limited and it is appropriate to study any kind of flocculation mechanism.

The optical techniques used to study the flocculation process require the previous manipulation of the suspension to dilute it or to adjust pH or ionic strength, and their results are affected by the turbidity of the suspension, which usually decreases during flocculation. This methodology does not require the previous manipulation of the suspension and the measurement is not affected by the turbidity or the color of the sample. Therefore, it does not require assuming that turbidity and color of the suspension are constant.

The measurement interval of this technique is quite wide: from 0,5 µm to 2000 µm.

This methodology can be applied on-line and in-real time in an industrial process.

COMPETITIVE ADVANTAGES

This methodology allows studying and optimizing the flocculation and coagulation processes (determination of mechanism and floc properties, selecting the optimal flocculant, dosage and conditions) in a faster and more efficient way, which decreases the cost of research.

Flocculation optimisation and control at industrial scale reduce chemical costs and favors the full process detecting any alteration on the process before it affects to the production.

The removal of chemical excess favours the later treatment of process waters and effluents.